## MOTION PICTURES OF WEATHER MAPS: A REPORT OF PROGRESS.[1]

By J. WARREN SMITH.

[Author's abstract.]

A project is well underway to illustrate the movement of storms and general weather conditions across the country by means of motion pictures.

Scenarios have been outlined to show: (1) The movement of a West Indian hurricane from the Atlantic into and across the Gulf of Meixco, its curving path onto the mainland and across the United States, and its movement across the Great Lakes and down the St. Lawrence to the North Atlantic; (2) the movement of cold waves; (3) heavy rainfall and floods; (4) heavy snowstorms; (5) local thunderstorms and tornadoes; and (6) comparisons of the climate of different sections of the country.

The movement of the hurricanes and of other weather conditions will be shown by weather maps drawn for each 15 minutes. Each map will be photographed from 6 to 48 times. Proper explanatory heads will be made and the weather maps will be accompanied by a suitable collection of motion pictures to illustrate the weather conditions and effects. These will consist in part of storm damage, waves on the coast, orchard heating, snow scenes, etc.

It is believed that these pictures will be of high educational value and show the work of the Weather Bureau and the marked value of its forecasts and warnings.

[1] Presented before the joint meeting of the Am. Meteorlogical Soc., Assoc. of Am. Geographers and Nat'l Council of Geog. Teachers, St. Louis, Mo., Dec. 31, 1919.

## DETERMINATION OF THE NORMAL TEMPERATURE BY MEANS OF THE EQUATION OF THE SEASONAL TEMPERATURE VARIATION AND OF A MODIFIED THERMOGRAPH RECORD.[1]

By FRANK L. WEST, N. E. EDLEFSEN, and S. P. EWING.

[Utah Agricultural College, Logan, Utah.]

[From authors' abstract.]

The daily and annual march of normal temperature in the arid west may be approximated from a pair of formulas where bulky tables are not convenient.

The normal air temperature is a periodic function of the time, there being two prominent periods, a 24-hour and an annual period. The mean daily temperature for the different days of the year for Utah was plotted and the following empirical equation for the curve was obtained by the Fourier series:

$$T=48.5-22.2 \cos (\theta-19°54')-2.7 \cos 2 (\theta-149°5') -1.0 \cos 3 (\theta-17°3') \ldots.$$

in which $T$ represents the mean annual temperature and $\theta$ the time expressed in degrees, e. g., April 1 = 90°, July 1 = 180°, etc. The same curve for widely separated places in the interior of the United States are nearly identical in shape, and, when superimposed on the curve for Utah, in the most extreme case, projected but 2 degrees above the maximum and 2 degrees below the minimum. The first term in the above equation is the mean annual temperature for the place considered, and simply displaces the curve up and down on the page, while the amplitude is determined by the difference in temperature between winter and summer, and varies in different places in the interior of the United States from the Utah value by from 1 to 4 degrees F. The above equation, therefore, is of general application.

The curve representing the diurnal temperature change modifies its shape gradually each day flattening out as winter approaches. We find that the daily variation in temperature is about twice as much in summer as in winter. However, the ratio of the hourly temperatures is nearly constant whatever day of the year is selected, e. g., the ratio of the maximum to the mean (on the Fahrenheit scale) is approximately a constant for all days of the year. The equation for this daily curve is as follows:

$$P=97.3-25.2 \cos (\theta-67°10')+3.7 \cos 2 (\theta-38°)- 1.5 \cos 3 (\theta-23°16') \ldots.$$

in which $P$ represents in per cent of the mean daily temperature of the hour of which $\theta$ is the time of day expressed in degrees; e. g., 6 a. m. = 90°, noon = 180°, etc. This equation is also of general application. Using the above method, it is found that in the arid west the chances are one in six that the actual temperature will differ from the computed value by less than 2° F., two in five that it will be as large as 5° F., one in four that it will be as much as 10° F., and one in seven that it will be as much as 15° F. Cyclones and anticyclones are the main causes of these departures.

DISCUSSION.

The discussion brought out clearly that although these formulas could be used to advantage in the absence of tables to compute probable temperatures on some future date, the results of such a computation would be in no sense a long-range forecast.

Dr. West called attention to the effect of the curved time lines on a thermograph sheet in making the afternoon decline of temperature appear much steeper than the morning rise, whereas for several hours on either side of the maximum the two are of practically the same order.

[1] Presented before Am. Meteorological Soc., St. Louis, Mo., Dec. 31, 1919.

## *DR. JOHN AITKEN.*[1]

The death of Dr. John Aitken, LL. D., F. R. S., on November 13 at the age of 80 is announced. Dr. Aitken was best known to meteorologists for his researches concerning dust particles in the atmosphere and their functions as nuclei of cloudy condensation, and for his theory of the formation of dew. His other investigations covered a wide field.—*Met'l Office Circular, Dec. 1, 1919, p. 4.*

Probably the name of John Aitken will be associated more particularly with the discovery of the place of dust in the functions of the atmosphere, and to the revision of the theory of dews, but his services to experimental meteorology are much more extensive. His valuable researches on the measurement of air temperature have never been fully appreciated by meteorologists and it is to be feared that they are little known. They deal almost exhaustively with the effect of radiation on thermometer bulbs of different size and surface, with the effect of shelter in thermometer screens, the influence of a current of air flowing over the bulbs, and the possibility of securing such a current by the use of a chimney of appropriate size and suitable surface. * * *

[1] A longer discussion of the life and work of Dr. John Aitken is to be found in *Nature* (London), Nov. 27, 1919, pp. 337-338.

To Dr. Aitken his researches were everything. He shrank from public appearances and had no ambition to take a leading part in the conduct of scientific societies. He was equally indifferent to the conventional opinions which dominate so many scientific workers, and cared little for scientific orthodoxy if the plain leading of observation and experiment ran athwart its canons.—*Extract from Symons's Met'l Magazine, Dec., 1919, pp. 125–126.*

## COMPOSITION OF THE ATMOSPHERE OF THE SOIL.

[Reprinted from Scientific American, New York, Apr. 6, 1919, p. 428.]

From 10 to 20 per cent by volume of the soil is composed of air, but this "atmosphere of the soil" differs from the superficial atmosphere in composition and is likewise more variable. The percentages of its constituents vary likewise from season to season. Recent investigations of this subject by two English scientists, Messrs. Russel and Appleyard, at Rothamstead in England, furnish some interesting data. To a depth of 0.15 meter the soil atmosphere is very similar to that of ordinary air, though containing a litle more carbon dioxide, but the total amount of carbon dioxide plus oxygen is less than in the air. During periods of active nitrification the percentage of oxygen diminishes, and this is one of the conditions which characterizes the so-called "awakening" of the earth in spring.

Besides the atmosphere entangled in the interstices of the soil there is a certain amount of air dissolved in the water and the colloids the soil contains, but this is almost entirely deprived of oxygen.

From November to May the curves follow the temperature, but from May to November the percentage of oxygen in the atmosphere of the soil increases with every rainfall (as does bacterial activity), which proves that the soil-atmosphere is renewed by the rain. This fact indicates that rain is superior to irrigation. As might be expected, soil which is covered with turf contains more carbon dioxide and less oxygen than arable earth. The composition of the soil-atmosphere appears to be but slightly affected by variations in barometric pressure, by temperature, by velocity of the wind, or by crop conditions.

## THE NITROGEN COMPOUNDS IN RAIN AND SNOW.

By F. T. SHUTT and R. L. DORRANCE.

[Reprinted from Science Abstracts, Sec. A, Feb. 28, 1919. Sec. 146.]

The paper summarizes the results of 10 years' work on the nitrogen compounds brought to the earth by rain and snow at a station near Ottawa. A total of 65.8 pounds of nitrogen per acre was furnished in this way in the 10 years, made up of 34.1 pounds in the form of free ammonia, 10.1 pounds of albuminoid ammonia, and 1.6 pounds of nitrates and nitrites. The rain was caught in a tray 60 inches by 30 inches. Every separate fall of rain of more than 0.01 inch was analyzed, while in the case of continuous precipitation measurements were made twice a day. During a period of severe drought when bush fires were prevalent in the neighborhood the scanty rain was particularly rich in free ammonia. Rain was found on the average to be approximately twice as rich as snow in nitrogen compounds, but the individual samples showed more variability with rain than with snow.

## THE ROARING OF THE MOUNTAIN AND ASSOCIATED PHENOMENA.[1]

By W. J. HUMPHREYS.

[Author's abstract.]

In many mountainous regions it is a common thing to refer to the "roaring" of the mountain as a sign of a general storm, within 6 to 24 hours, and the "sign" is a good one.

In the Allegheníes, for instance, where the general trend of the ridges is northeast to southwest, an approaching cyclone very often causes the winds to blow across the crests from the southeast, or in such direction as to bring precipitation. In such cases noises on the windward side of a mountain are often distinctly heard in the leeward valley where at other times they are quite inaudible; the sighing of the wind among the trees on the top is roughly focused by the wind also onto this valley, and merged into a cataract roar; the crest is soon mantled with cloud; a separate cloud billow parallels the mountain over the valley; and the winds beat strongly on a relatively narrow belt near or beyond the foot of the mountain. After a shorter or longer interval, the crest cloud thickens, the sky becomes covered throughout, and the precipitation begins. Such is the typical course of events when the mountain roars—all interesting and all explainable.

[1] Presented before the American Meteorological Society, St. Louis, Dec. 30, 1919.

## SOME APPLICATIONS OF RADIOTELEGRAPHY TO METEOROLOGY.[1]

By Prof. J. C. JENSEN, Nebraska Wesleyan University.

[Author's abstract.]

It is the experience of every radio operator that his efficiency in receiving will be much lessened during the summer months because of ever-present static interference. Observations extending over several seasons in the writer's station, 9YD, show that there is a definite relation between the radio transparency and amount of static disturbance of the atmosphere and the distance and violence of an approaching storm. This is peculiarly true of local thunderstorms which have always proved difficult for the forecaster. This suggests the desirability of concerted action for the simultaneous observation of storms as they pass a given region, along the lines proposed in antebellum days by the British Association for the Advancement of Science. A series of radio stations associated with the Weather Bureau would also be of great value both in gathering additional data during the day and in sending out storm and cold-wave warnings.

DISCUSSION.

*Mr. J. P. Henderson* remarked that the times of maximum static seems to be different in different parts of the world.

*Prof. Jensen* stated that the maximum static occurs at twilight, and with a falling barometer. It is at least on clear days following a LOW.

*Lieut. Keyser* asked if static was more troublesome in summer than winter.

*Prof. Jensen* replied in the affirmative, and also noted that it was greater in cloudy weather, and in tropical regions.

*Lieut. Keyser* remarked that radio-directional apparatus had been used to locate thunderstorms.

[1] Presented before the American Meteorological Society, St. Louis, Mo., Dec. 30, 1919.